

# APSM 152A: PIPING, REFRIGERANT EVACUATION & RECOVERY

## Foothill College Course Outline of Record

Heading	Value
<b>Units:</b>	1.5
<b>Hours:</b>	12 lecture, 28 laboratory per quarter (40 total per quarter)
<b>Prerequisite:</b>	Per California Code of Regulations, this course is limited to students admitted to the Sheet Metal Apprenticeship Program.
<b>Degree &amp; Credit Status:</b>	Degree-Applicable Credit Course
<b>Foothill GE:</b>	Non-GE
<b>Transferable:</b>	None
<b>Grade Type:</b>	Letter Grade Only
<b>Repeatability:</b>	Not Repeatable

## Student Learning Outcomes

- A successful student will be able to safely bend, cut, assemble and solder or braze common small diameter copper piping associated with air conditioning systems.
- A successful student will be able to demonstrate standing pressure testing and leak detection procedures for air conditioning piping.

## Description

Students are introduced to the materials and types of connections used in HVAC piping. Students learn how to safely evacuate and recover HVAC refrigerants.

## Course Objectives

The student will be able to:

- List the various types of piping associated with heating and air conditioning
- Demonstrate the ability to measure, cut, bend, and make various types of tubing and piping connections
- Demonstrate the safe use of soldering and brazing equipment
- List proper evacuation practices
- Demonstrate standing pressure testing and leak detection procedures
- Demonstrate use of recovery equipment

## Course Content

- List the various types of piping associated with heating and air conditioning
  - List the different types of tubing used in heating and air conditioning operations (Lec and Lab)
- Demonstrate the ability to measure, cut, bend, and make various types of tubing and piping connections
  - Describe two ways of cutting copper tubing (Lec and Lab)
  - List procedures for bending tubing (Lec and Lab)
  - Ability to braze and solder (Lec and Lab)
  - Make flared joints (Lec and Lab)
  - Swage joints (Lec and Lab)

- Prepare and thread steel pipe (Lec and Lab)
- List four types of plastic pipe and describe uses for each (Lec and Lab)
- Describe alternative methods of connecting pipe (Lec and Lab)
- Demonstrate the safe use of soldering and brazing equipment
  - Pass written safety test on use of soldering and brazing equipment (Lec and Lab)
  - Explain and demonstrate proper use of gas torches for safe operation (Lec and Lab)
- List proper evacuation practices
  - List some of the proper evacuation practices (Lec and Lab)
  - Describe two different types of evacuation (Lec and Lab)
  - Describe two different types of vacuum measuring devices (Lec and Lab)
  - Choose a proper high-vacuum pump (Lec and Lab)
  - Describe a high-vacuum single evacuation (Lec and Lab)
  - Describe a triple evacuation (Lec and Lab)
- Demonstrate standing pressure testing and leak detection procedures
  - Describe a standing pressure test (Lec and Lab)
  - Choose a leak detector for a particular type of leak (Lec and Lab)
- Demonstrate use of recovery equipment
  - Review EPA regulations regarding recovery of refrigerants and recovery equipment (Lec and Lab)
  - Demonstrate use of recovery equipment (Lec and Lab)

## Lab Content

- Demonstrate proper evacuation of HVAC refrigerant.
- Demonstrate proper recovery of HVAC refrigerant.

## Special Facilities and/or Equipment

- Laboratory with sheet metal service tools
- Personal protective equipment

## Method(s) of Evaluation

- Results of written quizzes and tests
- Responses in class discussions
- Comprehensive written final examination
- Demonstration of assigned skills to acceptable level per instructor

## Method(s) of Instruction

- Lecture
- Discussion
- Demonstration
- Lab assignments followed by discussion

## Representative Text(s) and Other Materials

Whitman, B., B. Johnson, J. Tomczyk, and E. Silberstein. Refrigeration and Air Conditioning Technology. 8th ed. Boston, MA: Cengage Learning, 2016.

## Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

- Sample reading assignment: From textbook, Unit 7, "Tubing and piping"
- Sample writing assignment: Complete review questions related to assigned reading

## **Discipline(s)**

Sheet Metal, Air Conditioning, Refrigeration, Heating